mechanical, acoustic or otherwise, to induce the desired amount of mixing according to application specific parameters.

Referring to FIG. **10**, in operation, fuels flowing through the fuel passages **50** in the direction of arrow **32** are caused to change direction and mix by the mixing members **52** and contact the permeable membrane **48**. Vacuum creates an oxygen partial pressure differential between the inner walls of the fuel passage **50** and the porous membrane **42** which causes diffusion of oxygen dissolved within the fuel to migrate into the porous substrate **38** and out of the deoxygenator assembly **12** separate from the fuel flow **32**. A result of the reduced oxygen content in the fuel is an increase in the thermal oxidative stability of the fuel that is manifested by a reduction of the formation of the objectionable deposits known as "coke". The increase in the temperature at which significant "coke" occurs increases the exploitable cooling capacity of the fuel. The cooling capacity of the fuel is rated in regard to the temperature at which auto-oxidation occurs to form coke deposits on the inner surfaces of fuel systems or engine components.

Removing dissolved oxygen increases the exploitable cooling capacity allowing lower grades of fuel to operate at increased temperatures and to recover waste heat. This reduces fuel consumption costs associated with operation of an aircraft and further reduces maintenance requirements. Further, increased cooling capacity allows for operation of an engine at increased temperatures that in turn increases the overall efficiency of operating the engine. This invention provides the means of efficiently removing dissolved oxygen within fuel to increase thermal capacity thereby increasing engine operating efficiency.

The foregoing description is exemplary and not just a material specification. The invention has been described in an illustrative manner, and should be understood that the terminology used is intended to be in the nature of words of description rather than of limitation. Many modifications and variations of the present invention are possible in light of the above teachings. The preferred embodiments of this invention have been disclosed, however, one of ordinary skill in the art would recognize that certain modifications are within the scope of this invention. It is understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described. For that reason the following claims should be studied to determine the true scope and content of this invention.

What is claimed is:

1. A fuel deoxygenator assembly comprising:

a housing comprising a fuel inlet and a fuel outlet;

fuel plate defining fuel passages through said housing between said inlet and outlet;

a permeable membrane supported by a porous substrate on a non-fuel side, said permeable membrane in contact with fuel flowing through said fuel passages on a fuel side;

at least one opening within said housing in communication with said porous substrate for creating an oxygen partial pressure differential between said fuel side and said non-fuel side of said permeable membrane to draw dissolved oxygen out of fuel within said fuel passages.

2. The assembly of claim **1**, further comprising a polytetrafluoroethylene coating disposed on said fuel side of said permeable membrane.

3. The assembly of claim **1**, further comprising a perfluorinated glassy polymer disposed on said fuel side of said permeable membrane.

4. The assembly of claim **1**, further comprising a polyperfluorobutenyl vinyl ether disposed on said fuel side of said permeable membrane.

5. The assembly of claim **1**, comprising a vacuum source for providing a vacuum at said at least one opening for providing said oxygen partial pressure differential between said fuel passages and said porous substrate.

6. The assembly of claim **1**, further comprising a second opening for a flow of strip gas through said housing in communication with said porous substrate creating said oxygen partial pressure differential.

7. The assembly of claim **1**, wherein said fuel plate defines two sides of said fuel passages.

8. The assembly of claim **7**, wherein said fuel plate includes a plurality of members extending between said sides of said fuel passages to induce mixing of fuel flowing through said fuel passages.

9. The assembly of claim **7**, wherein said fuel plate includes an inlet portion and an outlet portion.

10. The assembly of claim **1**, wherein said fuel plate is sandwiched between two of said permeable membranes such that said permeable membrane forms a portion of said fuel passages.

11. The assembly of claim **1**, further comprising a plurality of said fuel plates sandwiched between a corresponding plurality of said permeable membranes disposed within said housing forming a plurality of said fuel passages.

12. The assembly of claim **11**, wherein each porous substrate is sandwiched between said permeable membranes, and each fuel plate is sandwiched between said permeable membranes.

13. The assembly of claim **1**, wherein said permeable membrane comprises a polytetrafluoroethylene amorphous fluoropolymer.

14. The assembly of claim **1**, wherein said permeable membrane comprises a polytetraflouroethylene.

15. The assembly of claim **1**, wherein a thickness of said permeable membrane is about four microns.

16. The assembly of claim **1**, wherein a thickness of said permeable membrane is between 1 and 4 microns.

17. The assembly of claim **1**, wherein a thickness of said permeable membrane is less than four microns.

18. The assembly of claim **1**, wherein said porous substrate is a plate.

19. The assembly of claim **18**, wherein said porous substrate is disposed within a vacuum frame, said vacuum frame including inlets in communication with said at least one opening.

20. The assembly of claim **1**, wherein approximately 97% or more of the dissolved oxygen is removed from the fuel within said fuel passages.

21. The assembly of claim **1**, wherein the fuel within said fuel passages is approximately 200 degrees Fahrenheit.

22. The assembly of claim **1**, wherein the fuel within said fuel passage is more than about 150 degrees Fahrenheit.

23. The assembly of claim **1**, wherein the permeable membrane is bonded to the porous substrate.

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